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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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EXAMINER

VINH, LAN

ART UNIT

PAPER NUMBER

1765

23

DATE MAILED: 05/16/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/206,027

Applicant(s)

COHEN ET AL.

Examiner

LAN VINH

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 3/15/2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3-8 and 10-40 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3-8 and 10-40 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other:

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DETAILED ACTION

Claim Objections

1. Claims 32, 37 are objected to because of the following informalities: In line 2 of claims 32 and 37, the term "great" appears to be a typographical error. The examiner suggests replacing "great" with-greater- Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1, 3, 5, 6, 7, 24-25, 27-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konecni et al. (EP 0849 779 A2)

Konecni discloses a process for forming a semiconductor structure using plasma etching comprising exposed a patterned substrate to a plasma generated from a gas mixture of argon, helium and hydrogen in a processing chamber/ a plasma generated from a gas mixture consisting of argon, helium and hydrogen (col 3, lines 52-57; col 6, lines 40-47 and fig. 4)

Unlike the instant claimed invention as per claims 1, 3, 24, Konecni does not disclose the specific percent by volume (etchant concentration/flow rate) of argon, helium, hydrogen in the gaseous mixture although Konecni discloses that his method comtemplates any suitable flow rates of the gases (col 4, lines 1-2)

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However, in a method of plasma etching, it is well known in the art that etching parameters such as etchant concentration and flow rate affect both the rate and quality of the plasma etching process (see prior art of record for evidence of this basis)

Therefore, since Konecni discloses that any suitable flow rates of gas can be used, it would have been obvious to adjust Konecni's gases flow rate by optimizing the same by conducting routine experimentation for the purpose of obtaining the best etch rate.

Regarding claim 5, Konecni discloses that the substrate surface comprises silicon oxide (col 5, lines 24-26)

Regarding claim 6, Konecni discloses that the plasma is capacitively and inductively powered by bias power (col 3, lines 42-44)

Regarding claims 7, 28, Konecni discloses introducing argon, helium, hydrogen into the processing chamber to establish a low or vacuum pressure of 10^{-7} to 10^{-8} Torr (col 4, lines 34-35; col 6, lines 30-45)

Regarding claim 30, Konecni discloses generating the plasma by delivering power level of between 150-450 W to the processing chamber (col 3, lines 40-43)

4. Claims 1, 3, 5, 6, 7, 24-25, 27-30 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. (US 5,534,445)

Tran discloses a method for fabricating a thin film transistor. This method comprises the step of exposing a patterned substrate to a plasma generated by a gas mixture of hydrogen with inerts gases such as argon and helium/a gas mixture consisting of argon, helium and hydrogen (col 4, lines 49-51).

Unlike the instant claimed invention as per claims 1, 3, Tran does not disclose the specific percent by volume (etchant concentration/flow rate) of argon, helium, hydrogen in the gaseous mixture.

However, in a method of plasma etching, it is well known in the art that etching parameters such as etchant concentration and flow rate affect both the rate and quality of the plasma etching process (see prior art of record for evidence of this basis)

Therefore, it would have been obvious to adjust Tran's gases flow rate by optimizing the same by conducting routine experimentation for the purpose of obtaining the best etch rate.

Regarding claim 5, Tran discloses that the substrate surface comprises silicon oxide (col 4, lines 20-21)

Regarding claim 6, Tran discloses that the plasma is derived by radio frequency supply (col 4, lines 56-57) reads on the plasma is capacitively and inductively powered

Regarding claims 7, 28, Tran discloses a pressure in the chamber at 180 mTorr (col 5, lines 47-48)

Regarding claim 30, Tran discloses generating the plasma by delivering power level of 20 W to the processing chamber (col 4, lines 47-49)

5. Claims 4, 8, 10-23, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konecni et al. (EP 0849 779 A2) in view of Kennard (US 5,935,874)

Claims 4, 8, 10-23, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tran et al. (US 5,534,445) in view of Kennard (US 5,935,874)

Konecni's method has been described above in paragraph 3. Tran's method has been described above in paragraph 4. Unlike the instant claimed inventions as per claims 4, 8, 14, Konecni/Tran does not specifically disclose the step of increasing the helium content/flow rate of the plasma to increase etching of the patterned substrate surface.

However, Kennard discloses a method for plasma etching a trench comprises the step of adding/increasing a flow volume of helium to a plasma etching gas mixture (col 3, lines 58-60)

Therefore, one skilled in the art would have found it obvious to modify Konecni/Tran by increasing the helium content/flow rate to the gas mixture as per Kennard especially because Kennard teaches that it is believed that the addition of a relatively high flow volume of helium improves the directionality of the etch by increasing the ion energy, thereby increasing the vertical etch rate into the trench (col 4, lines 5-9). Furthermore, it is also well known in the art that etching parameters such as etchant concentration and flow rate affect both the rate and quality of the plasma etching process. Therefore, it would have been obvious to adjust Konecni/Tran helium flow rate by optimizing the same by conducting routine experimentation for the purpose of obtaining the best etch rate.

Regarding claims 10, 15, 18-20, the detailed discussion regarding the specific claimed flow rates has been discussed above in paragraph 3.

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5. Claims 31-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Konecni et al. (EP 0849 779 A2) in view of Kennard (US 5,935,874)

Konecni discloses a process for forming a semiconductor structure using plasma etching comprising exposed a patterned substrate at a vacuum pressure of 10^7 - 10^8 Torr to a plasma generated from a gas mixture of argon, helium and hydrogen in a processing chamber at a power of 150-450 W (overlaps the claimed range of between 300-450 Watts / a plasma generated from a gas mixture consisting of argon, helium and hydrogen at a power level between about 300-450 Watts (col 3, lines 52-57; col 6, lines 40-47 and fig. 4)

Unlike the instant claimed inventions as per claims 31, 36, Konecni does not specifically disclose the step of increasing the helium content/flow rate of the plasma to increase etching of the patterned substrate surface.

However, Kennard discloses a method for plasma etching a trench comprises the step of adding/increasing a flow volume of helium to a plasma etching gas mixture (col 3, lines 58-60)

Therefore, one skilled in the art would have found it obvious to modify Konecni by increasing the helium content/flow rate to the gas mixture as per Kennard especially because Kennard teaches that it is believed that the addition of a relatively high flow volume of helium improves the directionality of the etch by increasing the ion energy, thereby increasing the vertical etch rate into the trench (col 4, lines 5-9).

Konecni also does not disclose the specific vacuum pressure, the percent by volume (etchant concentration/flow rate) of argon, helium, hydrogen in the gaseous

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mixture although Konecni discloses that his method comtemplates any suitable flow rates of the gases (col 4, lines 1-2)

However, in a method of plasma etching, it is well known in the art that etching parameters such as etchant concentration and flow rate, pressure affect both the rate and quality of the plasma etching process (see prior art of record for evidence of this basis)

Therefore, since Konecni discloses that any suitable flow rates of gas can be used and maintaining the chamber at relatively low or vacuum pressure (col 4, lines 28-30), it would have been obvious to adjust Konecni's gases flow rate and chamber pressure by optimizing the same by conducting routine experimentation for the purpose of obtaining the best etch rate.

Regarding claims 32, 37, fig. 2 of Konecni shows a patterned substrate having a contact region/feature 36 having a depth greater than the width (aspect ratio of the contact or feature) reads on the patterned substrate comprise a feature having an aspect ratio greater than about 4 to 1.

The limitations of specific volume of the etchants, as recited in claims 33-34, 38-39, have been discussed above.

Regarding claims 35, 40, the limitations of adjusting the gases volume/ flow rates by increasing/decreasing the gas volume has been discussed above.

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Giunn et al. (US 5,877,032) discloses varying etching parameters such as flow rate, pressure to change/affect the etch rate of the substrate during plasma etching (col 4, lines 4-8)

Response to Arguments

7. Applicant's arguments filed 3/15/2002 have been fully considered but they are not persuasive.

In traversing the examiner rejection, the applicants argue that no prior art has been cited to support the assertion that " it is well known in the art that etching parameters such as etchant concentration, temperature and flow rate affect both the rate and quality of the plasma etching process". The examiner disagrees because the reference of Guinn et al (US 5,877,032), as cited under prior art of record section in the previous action (paper no. 20), discloses that "discrete processing parameters (e.g., temperature, flow rate, pressure, source power) is varied to change the etch rateonly parameters that effect the etch rate when varied are selected for this purpose" (col 4, lines 3-12). Therefore, the examiner maintains that prior art has been cited to support the assertion that " it is well known in the art that etching parameters such as etchant concentration, temperature and flow rate affect both the rate and quality of the plasma etching process". In addition, changes in concentrations or other process condition of an old process do not impart patentability unless the recited ranges are critical . *In re Aller et al*, 105 USPQ 233.

The applicants also argue that the claimed invention achieves unexpected result over the prior art and refers to fig. 4 of the specification for evidence that the claimed step of "increasing the helium content of the plasma to increase etching of the patterned substrate surface" is contrary to what would have been expected by one skilled in the art and thus nonobvious on view of the prior art. However, the examiner recognizes that evidence of unobviousness must be commensurate in scope with the claims. *In re Kulling 14 USPQ 2d 1056*. In reviewing fig. 4 of the specification, the examiner notes that fig. 4 only illustrates that the etch rate increases as the volume of argon decreased from 75% by volume to 25% by volume. Fig. 4 is silent about the increasing of helium content of the plasma to increase etching of the patterned surface/etching rate as recited in claims 8, 14, 31, 36. Thus, the examiner asserts that that evidence of unobviousness does not commensurate in scope with the claims.

It is also argued that none of the prior art teaches that increasing the volume of helium increases the rate of etching. This argument is not persuasive because as recited in col 4, lines 5-9 of Kennard, Kennard discloses that "the addition of a relatively high flow volume of helium improves the directionality of the etch by increasing the ion energy, thereby increasing the vertical etch rate". Thus Kennard teaching certainly reads on increasing the volume of helium increases the rate of etching.

8. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

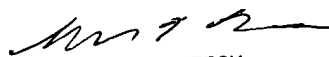
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to LAN VINH whose telephone number is 703 305-6302. The examiner can normally be reached on Monday-Friday 8:30 -6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, BENJAMIN L UTECH can be reached on 703 308-3836. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872-9310 for regular communications and 703 872-9311 for After Final communications.

LV
May 15, 2002


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